U.S. FISH AND WILDLIFE SERVICE SPECIES ASSESSMENT AND LISTING PRIORITY ASSIGNMENT FORM

SCIENTIFIC NAME: Huperzia stemmermanniae	
COMMON NAME: Wawae'iole	
LEAD REGION: Region 1	
INFORMATION CURRENT AS OF: April 2010	
STATUS/ACTION	
Species assessment - determined we do not have sufficient information on file to support a proposal to list the species and, therefore, it was not elevated to Candidate status New candidate Continuing candidate Non-petitioned Non-petitioned - Date petition received: May 11, 2004 90-day positive - FR date: Y 12-month warranted but precluded - FR date: May 11, 2005 Did the petition request a reclassification of a listed species?	l
FOR PETITIONED CANDIDATE SPECIES: a. Is listing warranted (if yes, see summary of threats below)? Yes b. To date, has publication of a proposal to list been precluded by other higher priority listing actions? Yes c. If the answer to a. and b. is "yes", provide an explanation of why the action is precluded. Higher priority listing actions, including court-approved settlements, court-ordered and statutory deadlines for petition findings and listing determinations, emergency listing determinations, and responses to litigation, continue to preclude the proposed and final listing rules for the species. We continue to monitor populations and will change its status or implement an emergency listing if necessary. The "Progress on Revising the Lists" section of the current CNOR (http://endangered.fws.gov/) provides information of listing actions taken during the last 12 months.	
	to

U – Taxon not subject to the degree of threats sufficient to warrant issuance of a
proposed listing or continuance of candidate status due, in part or totally, to
conservation efforts that remove or reduce the threats to the species.
F – Range is no longer a U.S. territory.
I – Insufficient information exists on biological vulnerability and threats to support
listing.
M – Taxon mistakenly included in past notice of review.
N – Taxon does not meet the Act's definition of "species."
X – Taxon believed to be extinct.

ANIMAL/PLANT GROUP AND FAMILY: Ferns and allies, Lycopodiaceae (Clubmoss family)

HISTORICAL STATES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands of Maui and Hawaii

CURRENT STATES/COUNTIES/TERRITORIES/COUNTRIES OF OCCURRENCE: Hawaii, islands of Maui and Hawaii

LAND OWNERSHIP: One population occurs on State land within Laupahoehoe Natural Area Reserve, and one population is on private land, both on the island of Hawaii. On Maui, one population occurred on Federal land in Kaapahu in Haleakala National Park.

LEAD REGION CONTACT: Linda Belluomini, (503) 231-6283, linda_belluomini @fws.gov

LEAD FIELD OFFICE CONTACT: Pacific Islands Fish and Wildlife Office, Christa Russell, 808-792-9400, christa russell@fws.gov

BIOLOGICAL INFORMATION

Species Description

Huperzia stemmermanniae is a pendant epiphytic clubmoss. Sterile stem bases are unforked or once-forked, short, usually much less than 6 inches (15 centimeters) long, green to pale yellow, with fertile terminal strobili. The strobili fork at an acute angle and the branches are usually straight (Palmer 2003, pp. 257-259).

Taxonomy

Phlegmariurus stemmermanniae was first described by A.C. Medeiros and W.H. Wagner (Medeiros *et al.* 1996, pp. 90-96). Kartesz (1999) moved the species to the genus *Huperzia* and this species is recognized as a distinct taxon in the latest treatment of ferns and fern allies, *Hawaii's Ferns and Fern Allies* (Palmer 2003, pp. 257-259).

Habitat/Life History

This species is epiphytic on rough bark of living trees or fallen logs in mesic to wet *Metrosideros* polymorpha-Acacia koa (ohia-koa) forests on east Maui and the island of Hawaii, between 3,199 to 3,806 feet (ft) (975 to 1,160 meters (m)) in elevation (Medeiros et al. 1996, p. 93; Palmer

2003, pp. 257, 259; Hawaii Biodiversity Mapping Program (HBMP) 2006a). *Huperzia stemmermanniae* has been reported growing on moss-covered logs of *Metrosideros* sp. and on *Syzygium sandwicensis* (ohia ha) trees. Associated native species include *Cheirodendron* spp. (olapa), *Cibotium* spp. (hapuu), *Cyrtandra* spp. (haiwale), *Ilex anomala* (kawau), *Melicope* spp. (alani), *Myrsine* spp. (kolea), *Psychotria* spp. (kopiko), and *Syzygium sandwicensis* (ohia ha) (Medeiros *et al.* 1996, p. 93).

Historical Range

There is little information available on the historical range of this species. *Huperzia stemmermanniae* was first collected in 1981 from two populations totaling 10 individuals in Laupahoehoe Natural Area Reserve (NAR) on the island of Hawaii, initially identified as *H. mannii* (Medeiros *et al.* 1996, p. 93; HBMP 2008). In 1996 Medeiros *et al.* described *Huperzia stemmermanniae* as a distinct taxon (Medeiros *et al.* 1996, pp. 90-96). At that time it was known from Laupahoehoe NAR and Kaapahu on east Maui.

Current Range/Distribution

Currently, this species is known from the Laupahoehoe NAR, and on private land, on the island of Hawaii, and from Kaapahu on east Maui (Hawaii Biodiversity and Mapping Program (HBMP) 2008; L. Perry, Hawaii Division of Forestry and Wildlife, pers. comm. 2006).

Population Estimates/Status

Currently, *Huperzia stemmermanniae* is known from three populations, one on east Maui of one individual that has not been relocated since the late 1990s, and two on the island of Hawaii, totaling approximately 30 individuals (Medeiros *et al.* 1996, p. 93; K. Wood, National Tropical Botanical Garden (NTBG), pers. comm. 2003; L. Perry, pers. comm. 2006). There is one population in the State's Laupahoehoe NAR, east of Blair Road of 10 to 20 individuals (L. Perry, pers. comm. 2006; K. Wood, pers. comm. 2003). On east Maui, there was one individual in Kaapahu in Haleakala National Park, but this individual has not been relocated since 1995 (P. Welton, National Park Service, pers. comm. 2008). A survey was conducted in Opana Gulch in the Koolau Forest Reserve on Maui in 2007, but no individuals were found (Plant Extinction Prevention Program (PEP) 2008, p. 67)

THREATS

A. The present or threatened destruction, modification, or curtailment of its habitat or range. The mesic to wet forest habitat of *Huperzia stemmermanniae* is highly and imminently threatened by feral pigs (*Sus scrofa*), goats (*Capra hircus*), cattle (*Bos taurus*), and axis deer (*Axis axis*) that degrade and destroy habitat (Medeiros *et al.* 1996, p. 96; K. Wood, pers. comm. 2003; HBMP 2008). Evidence of the activities of feral pigs has been reported at the Kaapahu and Laupahoehoe populations of *H. stemmermanniae* (S. Perlman, NTBG, pers. comm. 2010; HBMP 2008). Pigs of Asian ancestry were introduced to Hawaii by the Polynesians, and the Eurasian type was introduced to Hawaii by Cook in 1778, with many other introductions thereafter (Tomich 1986, p. 121). Some pigs raised as food escaped into the forests of Hawaii, Kauai, Oahu, Molokai, Maui, and Niihau, and are now managed as a game animal by the State (Tomich 1986, p. 125; State of Hawaii 2001). A study was conducted in the 1980s on feral pig populations in the Kipahulu Valley on Maui (Diong 1982, 408 pp.). This valley consists of a

diverse composition of native ecosystems, from near sea level to alpine, and forest types ranging from mesic to wet, *Acacia koa* to *Metrosideros polymorpha*. Rooting by feral pigs was observed to be related to the search for earthworms, with rooting depths averaging 8 in (20 cm), greatly disrupting the leaf litter and topsoil layers, contributing to erosion and changes in ground topography (Diong 1982, pp. 143-150). The feeding habits of pigs also created seed beds, enabling the establishment and spread of weedy species such as *Psidium cattleianum* (strawberry guava) (Diong 1982, pp. 164-165). The study concluded that all aspects of the food habits of pigs are damaging to the structure and function of the Hawaiian forest ecosystem (Diong 1982, pp. 166-167). The effects on mesic and wet forest habitat by foraging of feral pigs have also been reported in fencing studies. In a fencing study conducted in the montane bogs of Haleakala, it was found that when feral pigs were fenced out of an area the cover of native plant species increased from 6 percent to 95 percent within six years of protection (Loope *et al.* 1991, pp. i, 13).

Feral goats are reported to be a threat to the dense koa forest habitat of *Huperzia* stemmermanniae on Maui and the island of Hawaii (Medeiros et al. 1996, p. 96). The goat is originally native to the Middle East and India, was successfully introduced to the Hawaiian Islands in 1792. The effects on mesic and wet forest habitat by the foraging of feral goats have been reported in fencing studies. An exclosure analysis demonstrated that release from goat pressure by fencing resulted in an immediate recovery in height growth and numbers of vegetative resprouts of the native koa tree (Spatz and Mueller-Dombois 1973, p. 876). Another study at Puuwaawaa on the island of Hawaii demonstrated that prior to management actions in 1985, regeneration of endemic shrubs and trees in the grazed area was almost totally lacking, contributing to the invasion of the forest understory by exotic grasses and weeds. After the removal of grazing animals in 1985, koa and *Metrosideros* spp. seedlings were observed geminating by the thousands (Department of Land and Natural Resources 2002, p. 52).

Feral cattle are reported to be a threat to the dense koa forest habitat of *Huperzia stemmermanniae* on Maui and the island of Hawaii (Medeiros *et al.* 1996, p. 96). Cattle, the wild progenitors of which were native to Europe, northern Africa, and southwestern Asia, were introduced to the Hawaiian Islands in 1793. Large feral herds developed as a result of restrictions on killing cattle decreed by King Kamehameha I. While small cattle ranches were developed on Kauai, Oahu, and west Maui, very large ranches of tens of thousands of acres were created on east Maui and Hawaii. Feral cattle can presently be found on the islands of Hawaii and Maui, and ranching is still a major commercial activity. Cattle eat native vegetation, trample roots and seedlings, cause erosion, create disturbed areas into which alien plants invade, and spread seeds of alien plants in their feces and on their bodies. The forest in areas grazed by cattle becomes degraded to grassland pasture, and plant cover is reduced for many years following removal of cattle from an area (Cuddihy and Stone 1990, pp. 59-63; Tomich 1986, pp. 140-150). Several alien grasses and legumes purposely introduced for cattle forage have become noxious weeds (Tomich 1986, p. 145; Cuddihy and Stone 1990, pp. 47, 61-62).

Evidence of the activities of axis deer has been reported at the Kaapahu population of *Huperzia stemmermanniae* (HBMP 2008). Axis deer were introduced to Maui in 1959, with five being released east of Kihei. By 1968, the Maui population was estimated to be 85 to 90 animals and currently there is concern that their numbers could expand to 15,000 to 20,000 or more within a

few years (Waring 1996, p. 2; E. Nishibayashi, TNCH, in litt. 2001; S. Anderson, University of California-Davis, in litt. 2001). They trample roots and seedlings, cause erosion, and promote the invasion of alien plants (Cuddihy and Stone 1990, pp. 66-67).

Hawaiian ecosystems, having evolved without hoofed mammals, are susceptible to large-scale disturbance by pigs and other introduced ungulates (Loope *et al.* 1991, p. 3). As an epiphytic species, *Huperzia stemmermanniae* is provided some degree of protection from ground disturbance by feral ungulates (Medeiros *et al.* 1996, p. 96); however, because of the extent of demonstrated habitat modifications, such as destruction of native plants, disruption of topsoil leading to erosion, and establishment and spread of nonnative plants caused by feral pigs, goats, cattle, and deer, the Service believes they are threats to *H. stemmermanniae*.

B. Overutilization for commercial, recreational, scientific, or educational purposes. None known.

C. Disease or predation.

Predation by feral pigs, goats, cattle, and axis deer is a potential threat to *Huperzia stemmermanniae*. Because Hawaii's native plants evolved without any browsing or grazing mammals present, many lost natural defenses to such impacts (Merlin and Juvik, p. 597). Browsing by ungulates has been observed on many other native species, including common and rare or endangered species (Cuddihy and Stone 1990, pp. 63-67; Loope *et al.* 1991, p. 1,472). In a study conducted in the 1980s, feral pigs were observed browsing on young shoots, leaves and fronds of a wide variety plants, of which over 85 percent were endemic species (Diong 1982, p. 138). A stomach content analysis in this study showed that the pigs' food sources consisted of native plants, 60 percent of which was tree ferns (*Cibotium* spp.), alternating with *Psidium cattleianum* (strawberry guava) when it was available. Pigs were observed to fell plants and remove the bark of *Clermontia*, *Cibotium*, *Coprosma*, *Psychotria*, and *Hedyotis* species, with larger trees killed over a few months of repeated feeding (Diong 1982, pp. 138, 144). The ability of cattle to degrade native vegetation by grazing and trampling was recognized very soon after large-scale ranching began in Hawaii (Cuddihy and Stone 1990, pp. 59-63).

Feral goats eat native vegetation, are able to forage in extremely rugged terrain, and have a high reproductive capacity (Clarke and Cuddihy 1980, p. C20; van Riper and van Riper 1982, pp. 34-35; Scott *et al.* 1986, pp. 352-358; Tomich 1986, pp. 150-156; Culliney 1988, pp. 336-337; Cuddihy and Stone 1990, p. 64). Elimination of rare native plants such as *Argyroxiphium kauense* and *A. sandwicense* ssp. *sandwicense* (Hawaiian silverswords), *Canavalia kauensis* (awikiwiki), and a number of Maui species (*Stenogyne microphylla*, *Schiedea haleakalaensis*, *Plantago princeps*), from areas heavily foraged by goats has been documented (Cuddihy and Stone 1990, p. 64).

Deer are primarily grazers, but also browse numerous plant species including those grown as commercial crops. Damage to crops by the foraging of feral deer, costing farmers thousands of dollars in revenue, has been documented on Maui (Waring 1996, pp. 3-4; J. Simpson, Kula farmer, in litt. 2001).

As an epiphytic species (reported to grow on upright native trees as well as on fallen logs), *Huperzia stemmermanniae* may be afforded some degree of protection from these ground

disturbing mammals because individuals of this species may be unreachable by these animals (Medeiros *et al.* 1996, p. 96). However, even though there are no observations of browsing for this species, predation by feral pigs, goats, cattle, and axis deer is a potential threat to this species.

D. The inadequacy of existing regulatory mechanisms.

Huperzia stemmermanniae currently receives no protection under Hawaii's endangered species law (HRS, Sect. 195-D) or the Federal Endangered Species Act (16 U.S.C. §1531-1544).

Pig, goat, and deer hunting is allowed year-round, or during certain months, depending on the area (Hawaii Department of Land and Natural Resources 1999, 2003); however, public hunting does not adequately eliminate the threats posed by ungulates to native plant species (Hawaii Heritage Program 1990, p. 3). Hunting of feral cattle is no longer allowed in Hawaii (Hawaii Department of Land and Natural Resources 1985) except under permitted conditions.

E. Other natural or manmade factors affecting its continued existence.

Huperzia stemmermanniae is highly threatened by nonnative plants that degrade and destroy the forest habitat that supports the native species upon which this epiphytic plant grows (Medeiros *et al.* 1996, p. 96; HBMP 2008; L. Perry, pers. comm. 2006). With only three populations totaling 30 individuals on two islands, reduced reproductive vigor and extinction due to randomly occurring events, such as hurricanes, are also a potential threat to this species (Mangel and Tier 1994, pp. 607, 612; Pimm *et al.* 1998, pp. 757-758, 777).

The nonnative plant species that are threats to *Huperzia stemmermanniae* include *Sphaeropteris cooperi* (Australian tree fern), *Paspalum conjugatum* (Hilo grass), *Psidium cattleianum* (strawberry guava), and *Rubus argutus* (prickly Florida blackberry) at the east Maui populations; and *Psidium cattleianum* and *Clidemia hirta* (Koster's curse) at the Hawaii island populations (Medeiros *et al.* 1996, p. 96; HBMP 2008; L. Perry, pers. comm. 2006).

Clidemia hirta is a noxious shrub first cultivated on Oahu prior to 1941. This pest plant forms a dense understory, shading out native plants and hindering their regeneration, and is considered a serious plant threat (Wagner et al. 1985, p. 41; Smith 1989, p. 189). The most promising biological control to date for Koster's curse is the Collectrichum fungus, Gloesporioides f. sp. clidemiae, released in 1986. Although there is no quantitative data available, it has an observable negative impact. Other agents tested were a moth (Antiblemma acclinalis), a leaf-feeding beetle (Lius poseidon), a fruit and flower-feeding insect (Mompha trithalama), and a terminal growth-feeding insect (Liothrips urichi), all with lesser control success than the fungus (Smith 1989, p. 189).

Paspalum conjugatum is a grass native to the Neotropics, and was introduced for cattle fodder and quickly spread (Cuddihy and Stone 1990, pp. 82-83,). It is naturalized in moist to wet disturbed sites along roadsides and in open fields (O'Connor 1999, p. 1,576). It forms a dense ground cover even on acidic, low-nutrient soils (Pacific Island Ecosystems at Risk 2006). Its small hairy seeds are easily transported on humans and animals or are carried by the wind through native forests. No biological control agents have been released for this species (University of Hawaii 2006).

Psidium cattleianum, a tree native to tropical America, has become widely naturalized on all the main islands of Hawaii. Found in mesic to wet forests, *P. cattleianum* develops into dense stands in which few other plants can grow, displacing native vegetation. The fruit is eaten by pigs and birds, which then disperse the seeds throughout the forest (Smith 1985, p. 200; Wagner *et al.* 1985, pp. 40-41). A biological control agent, *Tectococus ovatus*, has undergone 15 years of testing, and there is a proposal to release this insect at Olaa Forest Reserve (ScienceDaily 2008).

Rubus argutus is native to the central and eastern United States, and is a serious weed that naturalizes in a variety of disturbed habitats (Tunison 1991, p. 2). It reproduces both vegetatively and by seed. Rubus argutus was introduced to Hawaii in the late 1800s and was quickly spread by birds (Wagner et al. 1999a, p. 1,107; Tunison 1991, p. 3). Biological controls were introduced (moths, sawfly, and beetle), but the damage to this nonnative species so far has been negligible (Nagata and Markin 1986, p. 53).

Sphaeropteris cooperi, a tree fern native to Australia, is used in landscaping in Hawaii because it is faster growing and more tolerant of warmer, drier conditions than the native Hawaiian tree ferns (Medeiros et al. 1992, pp. 30-31). It can achieve high densities in native Hawaiian forests, grows up to 1 ft (0.3 m) in height per year with maximum known heights of 39 ft (12 m) (Jones and Clemesha 1981, pp. 56-57), and can displace native species. Understory disturbance by pigs facilitates the establishment of *S. cooperi* (Medeiros et al. 1992, pp. 30-32). This species has been known to spread over seven miles (12 kilometers) by windblown dispersal of spores from plant nurseries (Medeiros et al. 1992, pp. 28-31; Palmer 2003, p. 245).

The original native flora of Hawaii consisted of about 1,400 species, nearly 90 percent of which were endemic. Of the current total native and naturalized Hawaiian flora of 1,817 taxa, 47 percent are introduced species, and nearly 100 species are pests (Smith 1985, p. 180; Wagner et al. 1999a, p. 45). Confirmed personal observations (Medeiros et al. 1996, p. 96; HBMP 2008; L. Perry, pers. comm. 2006) and several studies (Cuddihy and Stone 1990, p. 74; Robichaux et al. 1998, p. 4) indicate nonnative plant species may outcompete native plants that support individuals of the epiphytic *Huperzia stemmermanniae*. Competition may be for space, light, water, or nutrients, or there may be a chemical inhibition of other plants (Smith 1985, pp. 227-230; Cuddihy and Stone 1990, p. 74). In addition, nonnative pest plants found in habitat similar to that of this species have been shown to make the habitat less suitable for native species (Smith 1985, pp. 240-241; Loope and Medeiros 1992, pp. 7-8; Medeiros et al. 1992, p. 30; Ellshoff et al. 1995, pp. ii, 3-4; Meyer and Florence 1996, p. 778; Medeiros et al. 1997, pp. 23-24; Loope et al. 2004, p. 1,472). In particular, alien pest plant species degrade habitat by modifying availability of light, altering soil-water regimes, modifying nutrient cycling, or altering fire characteristics of native plant communities (Smith 1985, pp. 227-230; Cuddihy and Stone 1990, p. 74; Vitousek et al. 1997, pp. 6-10). Because of demonstrated habitat modification and resource competition by nonnative plant species in habitat similar to the mesic to wet Metrosideros polymorpha-Acacia koa habitat of H. stemmermanniae, the Service believes nonnative plant species are a threat to this species.

CONSERVATION MEASURES PLANNED OR IMPLEMENTED

This species is represented in two ex situ collections, one at Lyon Arboretum, the other at the

Volcano Rare Plant Facility (N. Sugii, pers. comm. 2006; L. Perry, pers. comm. 2006). No other known conservation measures have been implemented for this species.

SUMMARY OF THREATS

Based on our evaluation of habitat degradation and loss by feral pigs, goats, cattle, axis deer, and nonnative plants we conclude there is sufficient information to develop a proposed rule for this species due to the present and threatened destruction, modification, or curtailment of its habitat and range, and the displacement of the native plant species that provide physical support for individuals of the epiphytic *Huperzia stemmermanniae* due to competition with nonnative plants for space, nutrients, water, air, and light. Predation by ungulates is a potential threat to this species. The small number of remaining individuals and limited range make this species susceptible to randomly occurring natural events such as hurricanes. We find that this species is warranted for listing throughout all its range, and, therefore, find that it is unnecessary to analyze whether it is threatened or endangered in a significant portion of its range.

RECOMMENDED CONSERVATION MEASURES

- Control ungulates
- Control alien plants
- Continue collection for ex situ genetic storage and reintroduction
- Survey for populations at known locations and in suitable habitat
- Reintroduce individuals into suitable habitat within historic range that is being managed for known threats to this species

LISTING PRIORITY

THREAT			
Magnitude	Immediacy	Taxonomy	Priority
High	Imminent Non-imminent	Monotypic genus Species Subspecies/population Monotypic genus Species Subspecies/population	1 2* 3 4 5 6
Moderate to Low	Imminent Non-imminent	Monotypic genus Species Subspecies/population Monotypic genus Species Subspecies/population	7 8 9 10 11 12

Rationale for listing priority number:

Magnitude:

This species is highly threatened by feral pigs, goats, cattle, and axis deer that degrade and/or destroy habitat and nonnative plants that compete with the native species (that support this epiphytic plant) for light, space, and nutrients. This species is potentially threatened by predation by nonnative ungulates, and by randomly occurring events, such as hurricanes. Threats to the mesic to wet forest habitat of *Huperzia stemmermanniae*, and to individuals of this species, occur throughout its range and are expected to continue or increase without their control or eradication.

Immediacy of Threats:

Threats to *Huperzia stemmermanniae* from feral pigs, goats, cattle, deer, and nonnative plants are imminent because they are ongoing. Potential threats from predation by nonnative ungulates and randomly occurring events such as hurricanes are considered nonimminent.

Yes Have you promptly reviewed all of the information received regarding the species for the purpose of determining whether emergency listing is needed?

Is Emergency Listing Warranted? No. The species does not appear to be appropriate for emergency listing at this time because the immediacy of the threats is not so great as to imperil a significant proportion of the taxon within the time frame of the routine listing process. *Huperzia stemmermanniae* is represented in ex situ collections. If it becomes apparent that the routine listing process is not sufficient to prevent further losses that may result in this subspecies' extinction, then the emergency rule process for this species will be initiated. We will continue to monitor the status of *H. stemmermanniae* as new information becomes available. This review

will determine if a change in status is warranted, including the need to make prompt use of emergency listing procedures.

DESCRIPTION OF MONITORING

The information in this form is based on the results of two meetings of 20 botanical experts held by the Center for Plant Conservation in December 1995 and November 1996. We incorporated additional new information on this species from information in our files and from *Hawaii's Ferns and Fern Allies* (Palmer 2003). In 2004, the Pacific Islands Office contacted the following species experts: Robert Hobdy, retired from the Hawaii Division of Forestry and Wildlife; Joel Lau, Hawaii Natural Heritage Program; Arthur Medeiros, U.S.G.S. Biological Resources Discipline; Hank Oppenheimer, resource manager for the Maui Land and Pineapple Company; and Steve Perlman and Ken Wood, National Tropical Botanical Garden. No new status or range information was provided. In 2005 we contacted species experts, but received no new information on this taxon. In 2006 new status and range information was provided by Lyman Perry, Hawaii Division of Forestry and Wildlife; Hank Oppenheimer, Plant Extinction Prevention Program; and Nellie Sugii, Lyon Arboretum, and was incorporated into this assessment. In 2008, we received status information from Patti Welton, National Park Service. In 2009 we did not receive new information. In 2010, we contacted the species experts listed below, and received new information from Steve Perlman, National Tropical Botanical Garden.

List all experts contacted:

Date	Affiliation
02/09/10	Hawaii Division of Forestry and Wildlife
02/09/10	National Park Service, Haleakala NP, Maui
02/09/10	Private contractor
02/09/10	Plant Extinction Prevention Program, Molokai
02/09/10	U.S. Fish and Wildlife Service, Hawaii Island
02/09/10	National Park Service, Hawaii Island
02/09/10	The Nature Conservancy, Maui
02/09/10	Plant Extinction Prevention Program, Hawaii Island
02/09/10	West Maui Mountains Watershed Partnership
02/09/10	Hawaii Division of Forestry and Wildlife, Oahu
02/09/10	Plant Extinction Prevention Program, Oahu
02/09/10	Three Mountain Alliance
02/09/10	Hawaii Division of Forestry and Wildlife
02/09/10	East Maui Watershed Partnership
02/09/10	Hawaii Division of Forestry and Wildlife, Maui
02/09/10	The Nature Conservancy, Maui
02/09/10	National Park Service, Kalaupapa, Molokai
02/09/10	The Nature Conservancy, Hawaii Island
02/09/10	National Park Service, Haleakala NP, Maui
02/09/10	U.S. Fish and Wildlife Service, Maui
02/09/10	Bishop Museum
02/09/10	U.S.G.SBiological Resources Discipline
02/09/10	Hawaii Division of Forestry and Wildlife, Kauai
	02/09/10 02/09/10

Kawelo, Kapua	02/09/10	U.S. Army, Environmental Division
Kier, Matt	02/09/10	U.S. Army, Environmental Division
Kiyabu, Brian	02/09/10	Amy Greenwell Botanical Garden
Kraus, Jim	02/09/10	U.S. Fish and Wildlife Service, Hakalau NWR
Medeiros, Arthur	02/09/10	U.S.G.SBiological Resources Discipline
Misaki, Ed	02/09/10	The Nature Conservancy, Molokai
Moriyasu, Patty	02/09/10	Volcano Rare Plant Facility, Hawaii Island
Moses, Wailana	02/09/10	The Nature Conservancy, Molokai
Nakai, Glynnis	02/09/10	U.S. Fish and Wildlife Service, Maui NWR
Oppenheimer, Hank	02/09/10	Plant Extinction Prevention Program, Maui Nui
Palomino, Anna	02/09/10	Olinda Rare Plant Nursery, Maui
Palumbo, David	02/09/10	National Park Service, Haleakala NP, Maui
Pepi, Vanessa	02/09/10	U.S. Navy, Environmental Contractor
Perlman, Steve	02/09/10	National Tropical Botanical Garden
Perry, Lyman	02/09/10	Hawaii Division of Forestry and Wildlife, Hawaii
		Island
Plunkett, Bryan	02/09/10	Lanai Forest and Watershed Partnership
Pratt, Linda	02/09/10	U.S.G.SBiological Resources Discipline
Purell, Melora	02/09/10	Kohala Watershed Partnership
Seidman, Stephanie	02/09/10	Maui Nui Botanical Garden
Shishido, Glenn	02/09/10	Hawaii Division of Forestry and Wildlife, Maui
Silbernagle, Mike	02/09/10	U.S. Fish and Wildlife Service, Oahu NWR
		Complex
Smith, Miranda	02/09/10	Koolau Mountains Watershed Partnership
Starr, Forest	02/09/10	U.S.G.SBiological Resources Discipline
Tanaka, Daniel	02/09/10	Puu Kukui Watershed Preserve
Ward, Joe	02/09/10	Puu Kukui Watershed Preserve
Welton, Patti	02/09/10	National Park Service, Haleakala NP, Maui
Wood, Ken	02/09/10	National Tropical Botanical Garden
Wysong, Michael	02/09/10	Hawaii Natural Area Reserve System, Kauai

The Hawaii Biodiversity and Mapping Program identified this species as critically imperiled (HBMP 2006). Based on the International Union for Conservation of Nature and Natural Resources Red List of Threatened Species, this species is recognized as Endangered (could be considered at risk) by Wagner *et al.* (1999b, p. 57). *Huperzia stemmermanniae* is included in the list of species in Hawaii's 2005 Comprehensive Wildlife Conservation Strategy (Mitchell *et al.* 2005, p. B 7).

COORDINATION WITH STATES

On February 11, 2010, we provided the Hawaii Division of Forestry and Wildlife with copies of our most recent candidate assessments for their review and comment. No additional information or comments were received.

LITERATURE CITED

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APPROVAL/CONCURRENCE: Lead Regions must obtain written concurrence from all other Regions within the range of the species before recommending changes, including elevations or removals from candidate status and listing priority changes; the Regional Director must approve all such recommendations. The Director must concur on all resubmitted 12-month petition findings, additions or removal of species from candidate status, and listing priority changes.

Approve:		
Acting Co	onal Director, Region 1, Fish and Wildlife Service Date	
	ACTING: Director, Fish and Wildlife Service October 22, 2010	
Concur:		
Do not concur	r: Date: Director, Fish and Wildlife Service	
Director's Ren	montro.	
Director's Reii	narks:	
Date of annual Conducted by:	ll review: Date: April 14, 2010 : Cheryl Phillipson, Pacific Islands FWO Biologist, Prelisting and Listing Program	
Comments:		
PIFWO Revie	<u>ew</u>	
Reviewed by:	Christa Russell Date: April 22, 2010_ Prelisting and Listing Program Coordinator	
	Marilet Zablan Date: April 26, 2010 Assistant Field Supervisor, Endangered Species	
	Gina Shultz Date: April 30, 2010 Acting Field Supervisor	